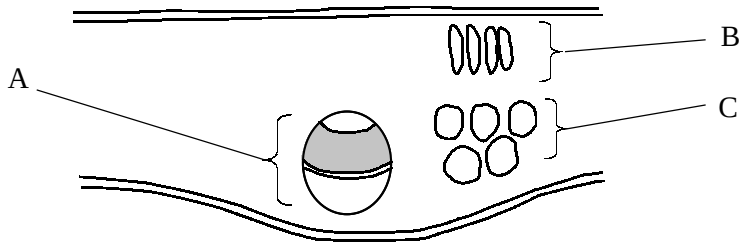
PHOTOSYNTHESIS

QUESTIONSHEET 1

The diagram below shows a vertical section through a leaf as seen under a light microscope.



(a) Name the parts A, B & C.

A: ..... [1]

B: ..... [1]

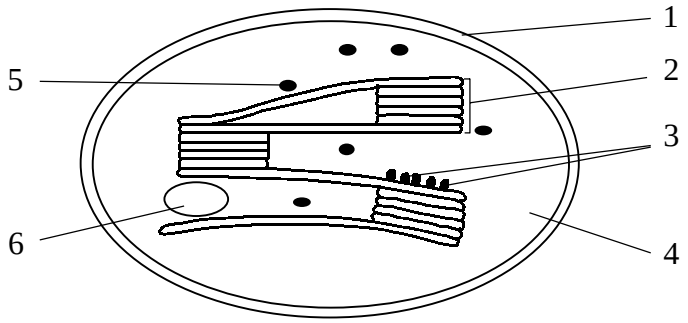
C: ..... [1]

(b) In which part would you find most chloroplasts?

.....

[1]

(c) The diagram below shows the electron microscope features of a chloroplast.



(i) Name structures 1 to 6.

1: ..... 2: ..... 3: .....

4: ..... 5: ..... 6: .....

[6]

(ii) What reaction of photosynthesis occurs in,

1. Structure 4: .....

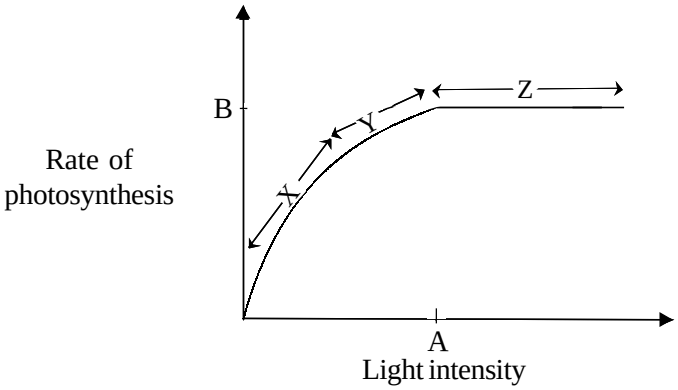
2. Structure 2: .....

[2]

TOTAL / 12 _____

QUESTIONSHEET 2

The graph below shows the effect of light intensity on photosynthesis.



(a) What is the limiting factor in region X?

.....

[1]

(b) What is being demonstrated at Y & Z?

.....

.....

.....

[3]

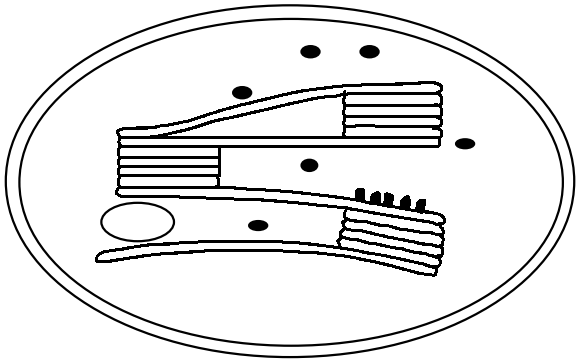
(c) Draw a simple apparatus that you could use to investigate the effect of light intensity on an aquatic plant such as Canadian Pondweed (Elodea canadiensis).

[3]

TOTAL /7

QUESTIONSHEET 3

The diagram below shows the ultrastructure of a chloroplast.



(a) On the diagram, label

(i) the site of the light dependent reaction of photosynthesis.
(ii) a site of the light independent reaction of photosynthesis.
(iii) a site of food storage.

[3]

(b) Radioactively labelled (^{14}C) carbon dioxide has been used to identify the intermediate compounds in the light independent stage of photosynthesis (Calvin cycle). Which intermediate compound would be the first to contain the ^{14}C?

.....

[1]

(c) Name three chloroplast pigments.

1 .....

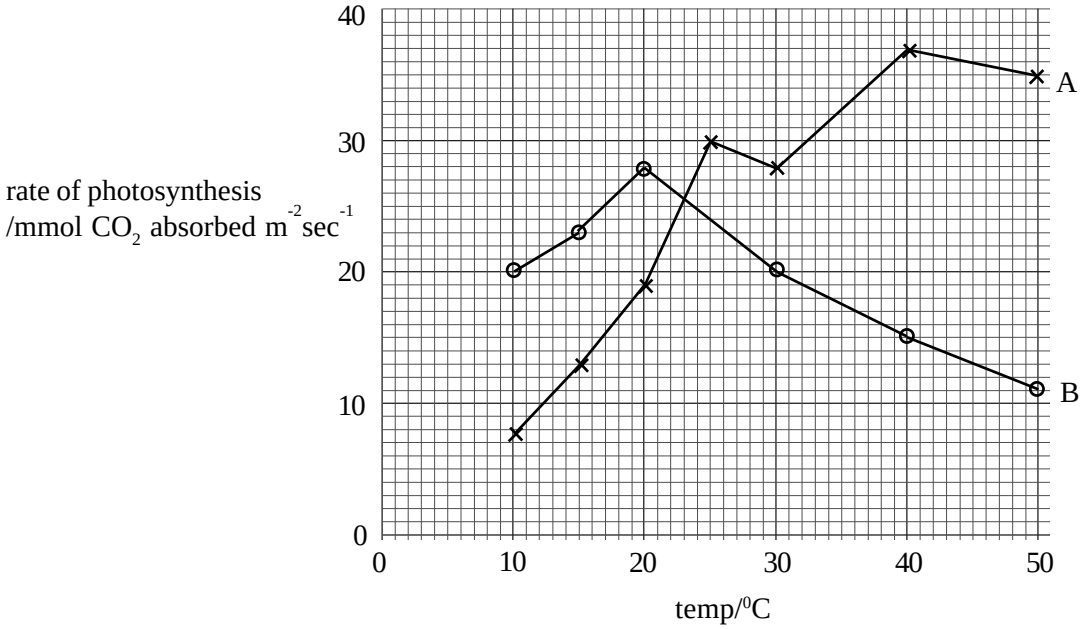
2 .....

3 .....

[3]

TOTAL /7

The graph below shows the effect of temperature on the rate of photosynthesis in two plants, A and B.



(a) Find the rate of photosynthesis at 17°C for both plants using the graph above.

A: .....

B: ..... [2]

(b) Which plant is likely to grow better in a cool, temperate region? Give a reason for your answer.

.....

.....

[2]

(c) Why does photosynthesis stop at high temperatures?

.....

[1]

(d) Name two environmental factors other than temperature which limit the rate of photosynthesis.

1: .....

2: .....

[2]

TOTAL /7

QUESTIONSHEET 5

The table below shows the results of an experiment in which the effect of different light intensities on the rate of photosynthesis of Canadian Pondweed was measured at two different carbon dioxide tensions. Sodium hydrogen carbonate was used as a CO_2 source. The different light intensities were obtained by placing a 60 watt lamp at different distances from the plant in a darkened room. The rate of oxygen evolution was measured as an indicator of photosynthetic rate.

Distance of lamp from plant/metres	2.00	1.50	1.00	0.75	0.50	0.25	0.10
Rate of O_2 release in 1% HCO_3^- /$mm^3\ min^{-1}$ A	0.2	0.4	0.7	1.4	1.4	1.4	1.4
Rate of O_2 release in 2% HCO_3^- /$mm^3\ min^{-1}$ B	0.6	0.8	1.1	1.5	1.8	1.8	1.8

(a) Plot the results on graph paper. [5]

(b) (i) Describe the relationship between light intensity and the rate of photosynthesis using curve B from your graph.

.....

.....

.....

[3]

(ii) Comment on the differences shown in the rates of photosynthesis in A and B.

.....

.....

.....

[3]

(c) The light intensity [I] at the plant is given by the formula: $I \propto \frac{1}{d^2}$ where d is the distance of the light source from the plant.

Calculate the light intensities in A and B at which the rate of photosynthesis starts to be limited. Show your working.

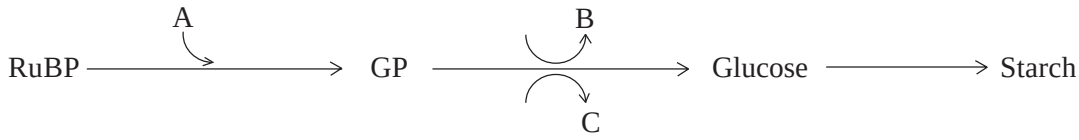
Answer A:..... Answer B:.....

[4]

TOTAL /15

QUESTIONSHEET 6

The diagram below shows part of the light independent reaction of photosynthesis.



(a) Identify compounds A, B and C.

A: ..... [1]

B: ..... [1]

C: ..... [1]

(b) Where in the chloroplast does this reaction take place?

.....

[1]

(c) Apart from being converted to glucose, what other use has GP?

.....

[1]

(d) State the source of compounds B and C in the photosynthetic process.

.....

.....

[2]

(e) How is glucose converted to starch?

.....

.....

[2]

TOTAL /9

QUESTIONSHEET 7

The table below shows the results of an experiment on the production and use of sugars in the leaves of a plant.

TEMPERATURE /°C	**RATE OF SUGAR PRODUCTION/USE /arbitrary units**		
	Photosynthesis (high light intensity)	Respiration	Net gain/loss
0	0	2	
10	36	4	
15	42	5	
20	72	6	
25	80	8	
30	48	16	
40	12	30	
50	0	20	
60	0	18	

(a) (i) From these figures work out the net gain/loss of sugar at each temperature and write the figures in the appropriate box on the table.

[2]

(ii) Plot the results of sugar production in photosynthesis, sugar use in respiration and net gain/loss at different temperatures, graphically.

[5]

(b) What are the optimum temperatures for,

(i) photosynthesis: .....

(ii) respiration? .....

[2]

(c) (i) Define the term ‘compensation point’.

.....

.....

[2]

(ii) Use the graph to estimate the temperature at which the plant reaches its compensation point.

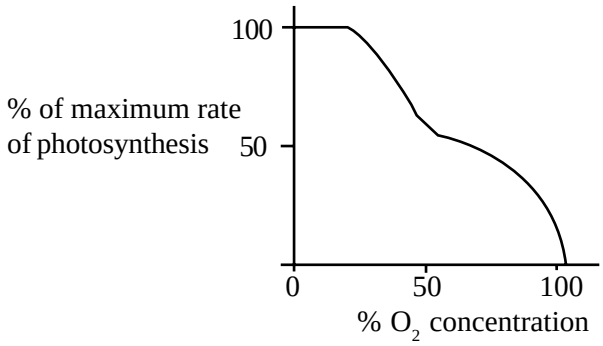
.....

[1]

TOTAL / 12 _____

QUESTIONSHEET 8

The graph below shows the effect of oxygen concentration on the rate of photosynthesis.



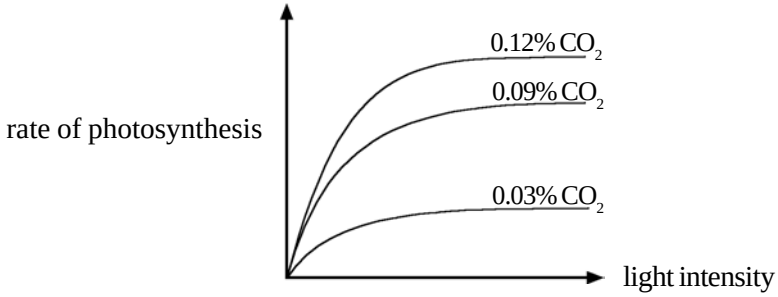
(a) Comment on the effect of oxygen concentration on photosynthesis.

.....

.....

..... [3]

The graph below shows the effect of changing the carbon dioxide concentration on the rate of photosynthesis.



(b) What conclusions can you draw from this graph?

.....

.....

.....

..... [4]

(c) (i) Define the term “compensation point”.

.....

..... [2]

(ii) Describe what happens when the compensation point is exceeded.

.....

..... [2]

(iii) Explain why it is of advantage for a woodland herb to have a low compensation point.

.....

..... [2]

TOTAL / 13

PHOTOSYNTHESIS

QUESTIONSHEET 9

Do not write in margin

(a) Distinguish between each of the following pairs of photosynthetic terms.

(i) Absorption spectrum and action spectrum.

.....

.....

.....

[3]

(ii) Cyclic and non-cyclic photophosphorylation.

.....

.....

.....

[3]

(iii) C_3 and C_4 plants.

.....

.....

.....

[3]

(b) Describe the function of each of the following in photosynthesis:

(i) magnesium ions.

.....

.....

[2]

(ii) quantosomes.

.....

.....

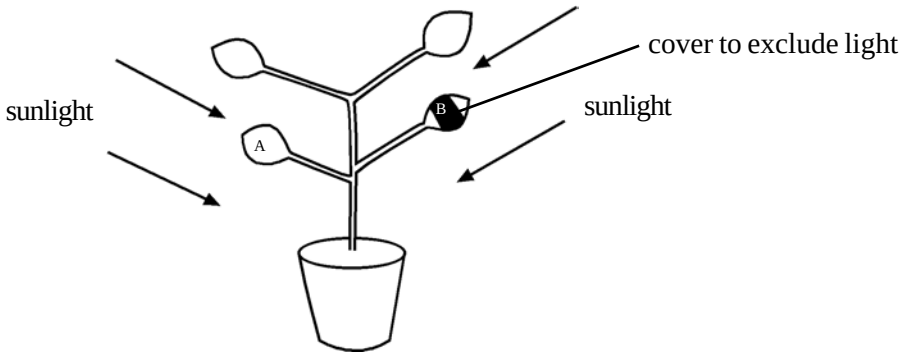
[2]

TOTAL /13

PHOTOSYNTHESIS

QUESTIONSHEET 10

The experiment below is designed to show that sunlight is necessary for photosynthesis.



The plant is destarched by leaving it in the dark for 48 hours prior to the investigation. It is then left in the sunlight for at least 5 hours.

(a) (i) Why is the plant destarched first?

.....

.....

[2]

(ii) Why does the plant destarch in the dark?

.....

.....

[2]

(b) Two leaves, A & B, are detached and tested for starch after 5 hours. Explain how you would test the two leaves for starch.

.....

.....

.....

.....

[5]

(c) Describe the expected results of the two leaves after testing for starch.

.....

.....

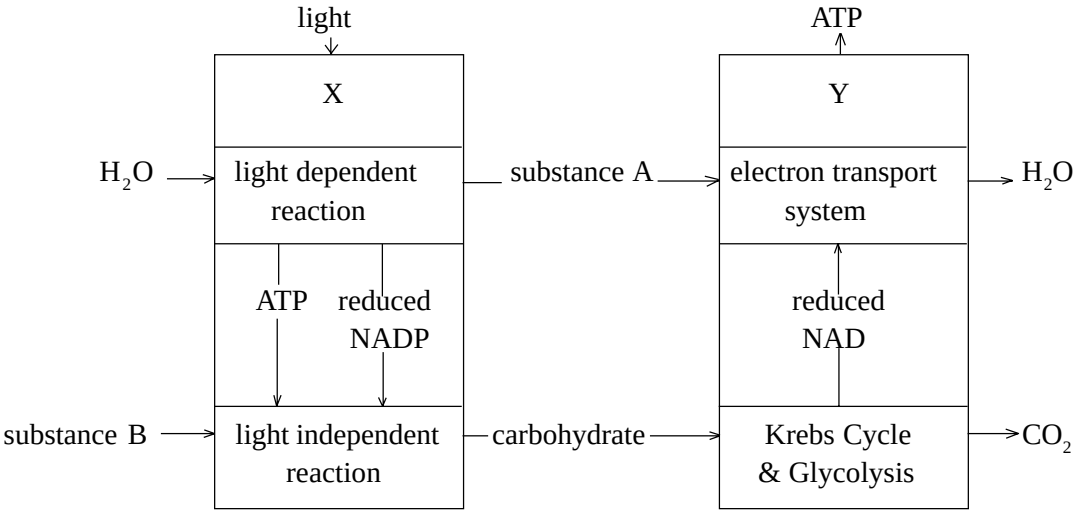
.....

[3]

TOTAL / 12 _____

QUESTIONSHEET 11

The diagram shows the biochemical processes taking place in two plant cell organelles:



(a) Name organelles X and Y and substances A and B.

X: ..... [1]

Y: ..... [1]

A: ..... [1]

B: ..... [1]

(b) Oxidative phosphorylation occurs in organelle Y and photophosphorylation occurs in organelle X. Outline the difference between oxidative phosphorylation and photophosphorylation.

.....

.....

.....

.....

.....

..... [6]

(c) (i) The light reaction produces ATP and NADPH, which are used in the dark reaction. What are they used for in the dark reaction?

.....

..... [2]

(ii) State two uses of ATP produced in plants.

1 ..... [1]

2 ..... [1]

TOTAL / 14

PHOTOSYNTHESIS

QUESTIONSHEET 12

Read through the following account of photosynthesis and then complete it by inserting the most appropriate word or words into the spaces.

There are three pigments commonly found in the chloroplasts of flowering plants. These are chlorophyll a, chlorophyll b and ..... . Chlorophylls absorb mainly ..... and ..... wavelengths of light. During cyclic photophosporylation the absorption of light causes the displacement of an electron from the chlorophyll molecule. This electron is returned to the chlorophyll via a series of ..... which are at progressively lower energy levels. Coupled with this electron flow is the synthesis of ..... This compound is then used in the light independent reaction which occurs in the ..... region of the chloroplast. During non-cyclic photophosphorylation, the electron is combined with ..... ions resulting from the photolysis of ..... to form the reduced coenzyme called ..... This reduced coenzyme is used in the ..... cycle to convert ..... acid to phosphoglyceraldehyde (PGAL). This can be converted to ..... which is the acceptor molecule for the carbon dioxide used in photosynthesis. The electron emitted from the chlorophyll molecule is replaced by electrons from the ..... ions produced by photolysis. As a result ..... gas is liberated.

[14]

(b) Explain why plants need a healthy root system to photosynthesise.

.....

.....

[2]

TOTAL / 16

QUESTIONSHEET 13

Suggest explanations for each of the following:

(a) Leaves in the tops of beech trees have two or three layers of palisade mesophyll cells, but the leaves lower down only have one layer of palisade mesophyll cells.

.....

.....

.....

.....

[3]

(b) Peas and beans tend to contain much higher concentrations of protein than cereals.

.....

.....

.....

.....

[2]

(c) Power stations frequently have adjacent man-made lakes containing algae, such as Chlorella.

.....

.....

.....

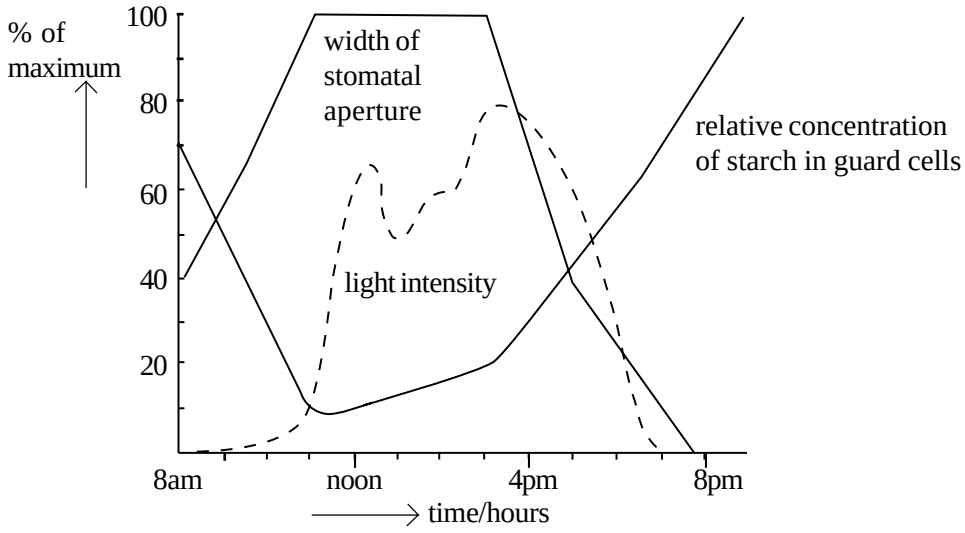
.....

[3]

TOTAL /8

QUESTIONSHEET 14

The graph below shows results of investigations into the mechanism of stomatal opening.



(a) Describe the relationship between stomatal aperture width and starch concentration between:

(i) 8.00 am and noon.

..... [1]

(ii) 4.00 pm and 8.00 pm.

..... [1]

(b) (i) Using information from the graph and your own knowledge, suggest a mechanism for stomatal opening.

.....

.....

.....

.....

.....

[4]

(ii) How might the width of stomatal aperture differ from the above, if the plant was in dry conditions during the 12 hour period? Explain your answer.

.....

.....

[2]

(c) Describe one technique which can be used to measure the stomatal density on the underside of a leaf.

.....

.....

.....

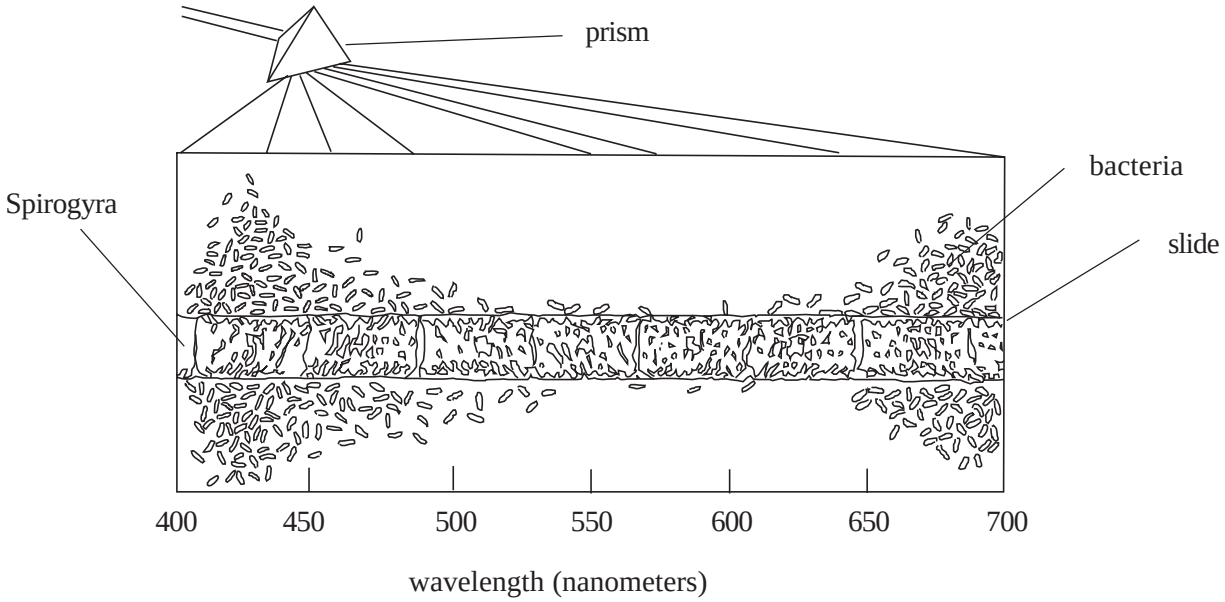
[3]

TOTAL / 11

PHOTOSYNTHESIS

QUESTIONSHEET 15

A drop of water containing a strand of the green algae, *Spirogyra*, and some free living aerobic bacteria were mounted on a microscope slide. The slide was then illuminated with light which was split into its constituent colours (wavelengths) using a prism. The figure shows the distribution of bacteria after a few minutes.



(a) Describe the distribution of bacteria.

.....

[1]

(b) Suggest an explanation for the distribution of bacteria.

.....

.....

.....

[3]

(c) Chloroplasts contain several pigments. What is the significance of this in photosynthesis?

.....

.....

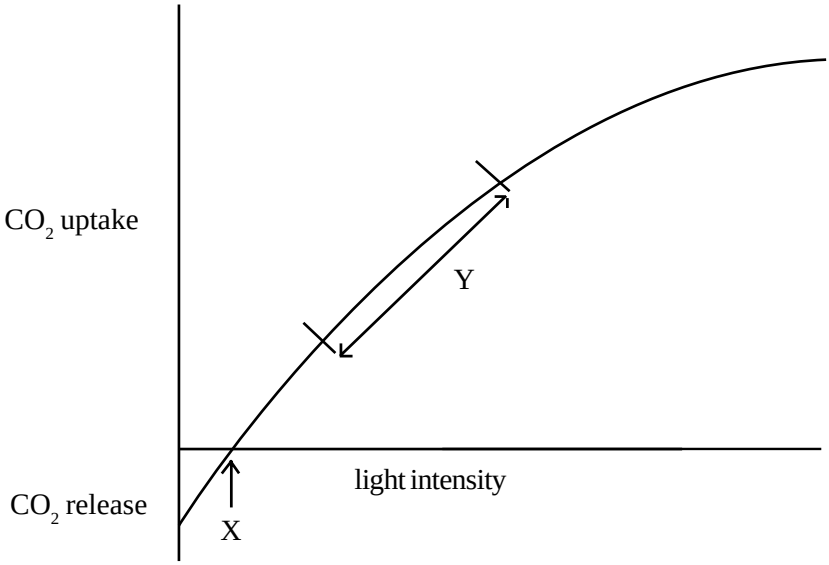
.....

[3]

TOTAL / 7

QUESTIONSHEET 16

The graph shows the effect of light on the uptake and release of carbon dioxide of a green plant.



(a) Outline the significance of light intensity X.

.....

.....

.....

[2]

(b) Explain the shape of the graph at Y.

.....

.....

[2]

(c) (i) List the products of the light reaction.

.....

[3]

(ii) Outline how products of the light dependent stage are used in the light independent stage of photosynthesis.

.....

.....

.....

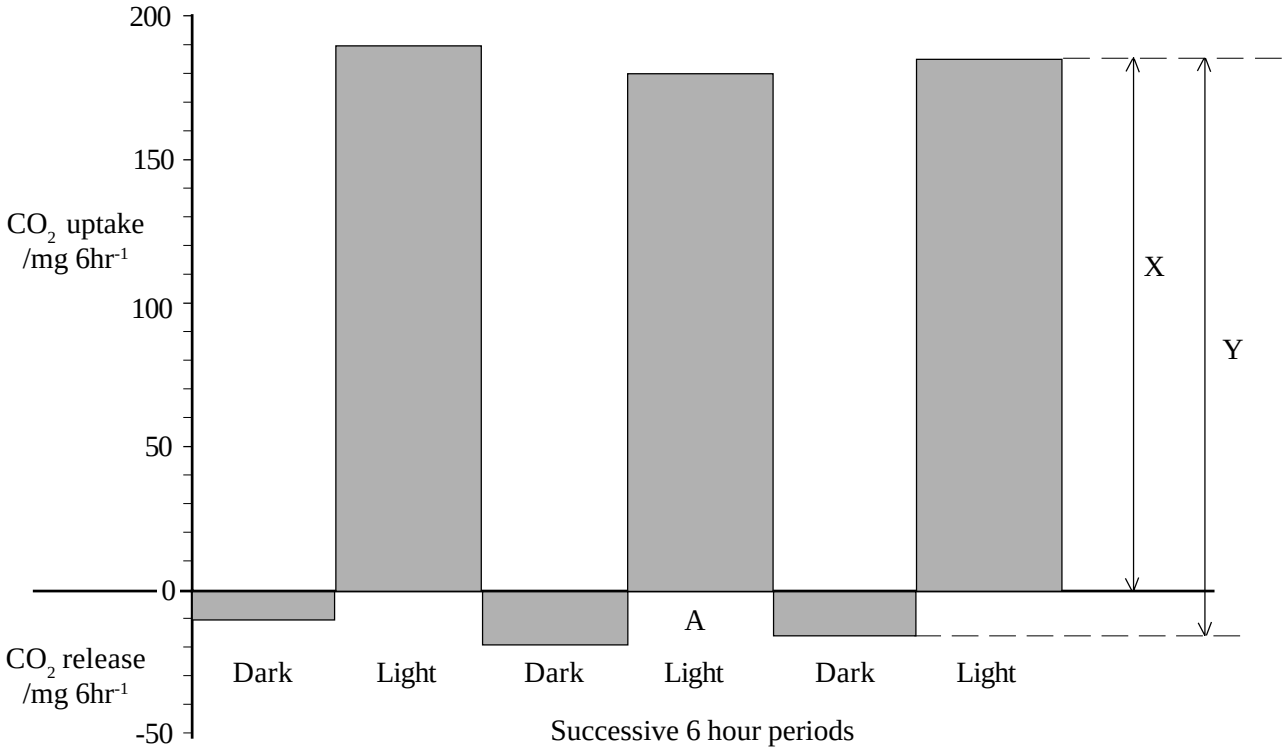
[2]

TOTAL / 9

QUESTIONSHEET 17

Do not write in margin

The graph shows the results of an investigation into the uptake and release of carbon dioxide by an aquatic green unicellular alga, such as Chlorella.



(a) Calculate the mean uptake of carbon dioxide over a six hour period in the light.

Answer ..... [2]

(b) Which of the two lines, X or Y, represent gross CO_2 use in photosynthesis? Explain your answer.

.....

.....

..... [3]

(c) For period A express the net photosynthesis as a percentage of the gross photosynthesis. Assume the respiration rate to be the same as in the previous dark period. Show your working.

Answer ..... [2]

(d) Waste gases containing CO_2 from power stations are sometimes pumped through pools containing Chlorella. Explain two benefits of this.

1 .....

..... [2]

2 .....

..... [2]

TOTAL / 11

QUESTIONSHEET 18

(a) State the main function of each of the following mineral ions in a healthy plant.

(i) nitrate: ..... [1]

(ii) phosphate: ..... [1]

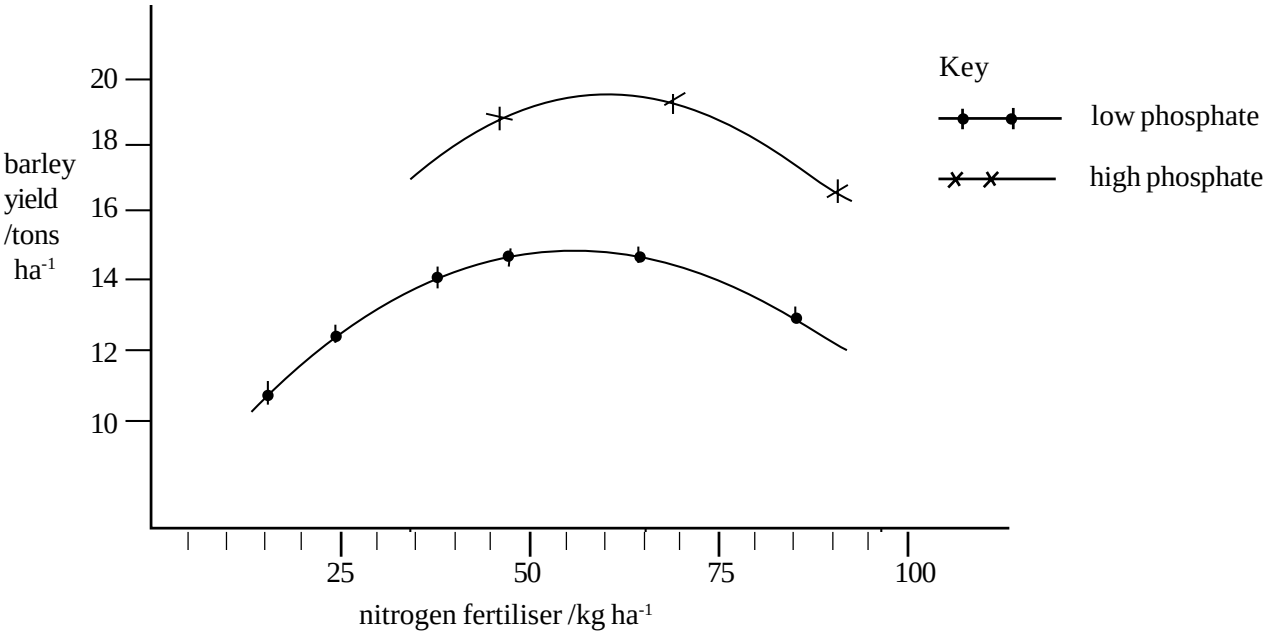
(iii) magnesium: ..... [1]

(b) What is meant by the term 'limiting factor'?

.....

..... [2]

In an investigation to determine the optimum application of nitrogen fertiliser to barley, trials were conducted in two fields. One of the fields had previously received high applications of phosphate fertiliser. The second field had previously received a low application of phosphate fertiliser. The graph shows the results of the investigation.



(c) (i) State the effect of phosphate levels on the yield of barley.

.....

[1]

(ii) Determine the optimum nitrogen application in the field which has received high phosphate.

..... [1]

(d) (i) State one possible harmful environmental consequence of adding too much nitrogen fertiliser.

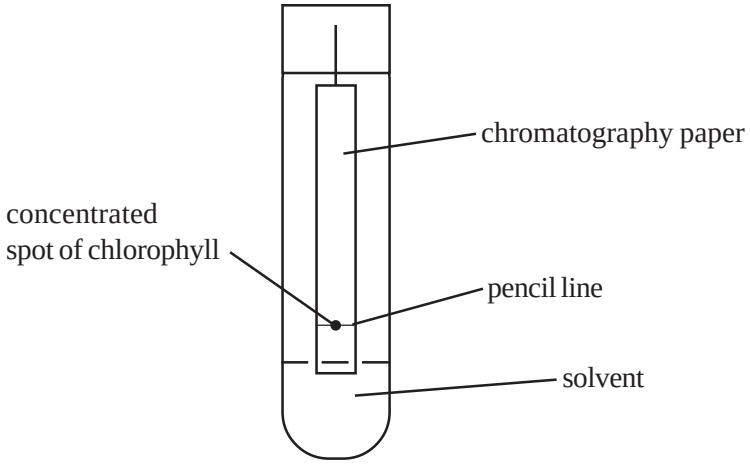
..... [1]

TOTAL / 8

QUESTIONSHEET 19

Do not write in margin

A student investigating chlorophyll pigments set up the apparatus shown in the figure below.



(a) Outline how the student would have obtained the chlorophyll spot.

.....

.....

.....

.....

[4]

(b) State two precautions which should be taken in setting up this investigation.

1: .....

2: .....

[2]

(c) Chlorophyll contains a number of pigments. Explain the biological significance of this.

.....

.....

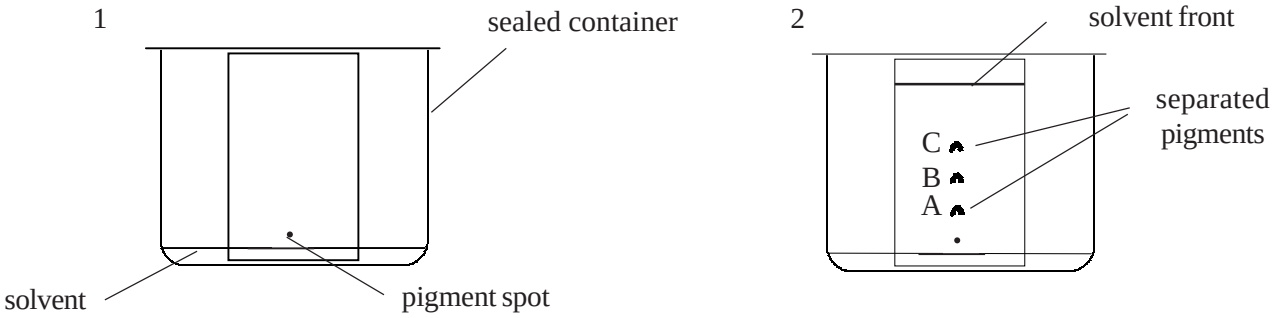
.....

[2]

TOTAL /8

QUESTIONSHEET 20

A student used paper chromatography to separate the pigments from a sample of petals. The procedure followed by the student is shown in the diagram below.



(a) State one precaution which the student should have taken in this investigation.

.....[1]

(b) Outline the chemical principle illustrated by this technique.

.....

.....

[2]

The table shows the distance moved by the solvent and pigments.

Substance	Distance moved (mm)
Solvent front	93
Pigment A	18
Pigment B	35
Pigment C	36

(c) (i) Define the term Rf value.

.....

.....

[2]

(ii) Calculate the Rf values for pigments B and C. Show your working.

Answer A ..... Answer B .....

[2]

(iii) Suggest one way by which greater separation of pigments B and C could have been achieved.

.....[1]

TOTAL / 8